Check List 2007: 3(2)
ISSN: 1809-127X

LISTS OF SPECIES

Fish, Itupararanga Reservoir, Sorocaba River Drainage, São Paulo, Brazil.

Welber Senteio Smith[1]
Miguel Petrere Jr.[2]

[1]Instituto Manchester Paulista de Ensino Superior - Universidade de Sorocaba. Rua Antonio Adade, 67, ap. 02. CEP 18048-020, Sorocaba, SP, Brazil. E-mail: welber_smith@uol.com.br

[2] Universidade Estadual Paulista - UNESP, Departamento de Ecologia. Avenida 24-A, 1515. CEP 13506-900, Rio Claro, SP, Brazil.

Abstract
The Itupararanga Reservoir is located at the Sorocaba River Basin, state of São Paulo, Brazil. Five cities use the waters of this reservoir for human consumption. Despite this intensive use of the water resource, no study has been undertaken, to investigate the ichthyofauna of this reservoir. Overall, 22 species of fishes were sampled, including 7 orders and 12 families. Characiformes and Siluriformes were the most representative with respectively 9 and 5 species. Among the families, Characidae and Pimelodidade are noticed, both with respectively 5 and 3 collected species.

Introduction

The Itupararanga reservoir is located in the headwaters of the Sorocaba river, southeast Brazil. This reservoir receives water from the Sorocabaçu and Sorocamirim rivers, which, in turn, join to form the Sorocaba River (Figure 1).

The reservoir was built in 1912, has a drainage area of 851 km^2, a maximum flow of 39.12 m^3/s^{-1} and a max volume of 286 millions of m^3. The power generation capacity is 55 MW, and the mean annual production of 150 Gwh, is exclusively used by the large Votorantim Corporation. The reservoir is located at the municipality of Votorantim, but it also drains four other municipalities: Ibiúna, Mairinque, Alumínio and Piedade. All these five cities use the water of the reservoir for human consumption.

Several studies reported the effects of damming on the ichthyofauna (Fernando and Holcick 1991; Beaumord 1991; Duncan and Kubecka 1995). In this regard it is worth mentioning those studies carried out in the reservoirs of the Paraná River Basin, especially at the Tiête River which receives the Sorocaba River (Petrere 1996; Agostinho, Bini and Gomes 1997; Barrella 1998; Smith 1999; Smith and Petrere 2001; Smith et al. 2002).

Damming, in some cases, can be an insurmountable barrier for any fish species, isolating sites and specific zones that otherwise would be routinely used for feeding or reproduction (Beaumord 1994; Agostinho and Zalewski 1996). This isolation can have a genetic effect on fish populations (Petrere 1996).

A reservoir creates a new lentic environment, which is expected to impact on the also below remnant community above the dam (Beaumord 1991; 1994). This community will suffer modifications related to a decrease in the abundance of some rheophilic species, and a concomitant increase in the number of species with a higher adaptive capacity for lentic environments, such as are the curimatids of the reservoirs of the Parana river basin (Barrella 1998; Smith and Petrere 2001) and *Hypophthalmus edentatus* and *Auchenipterus nuchalis* in the Itaipu reservoir (Agostinho, Julio Jr. and Petrere 1994).

According to Castro and Arcifa (1987), *Cyphocharax modestus* was the most abundant fish species in Southern Brazil reservoirs. Agostinho, Julio Jr. and Borghetti (1992) verified that before Itaipu damming, *Hypophthalmus edentatus* and *Auchenipterus nuchalis* were rare, but just after damming both became responsible for 20% of the catches. This happens basically because not all species adapt to this new habitat, so that a reduction in fish diversity occurs. Given this background, the objective of the present paper was to describe the ichthyofauna of Itupararanga reservoir, in which the fish fauna studies are relatively poor.

LISTS OF SPECIES

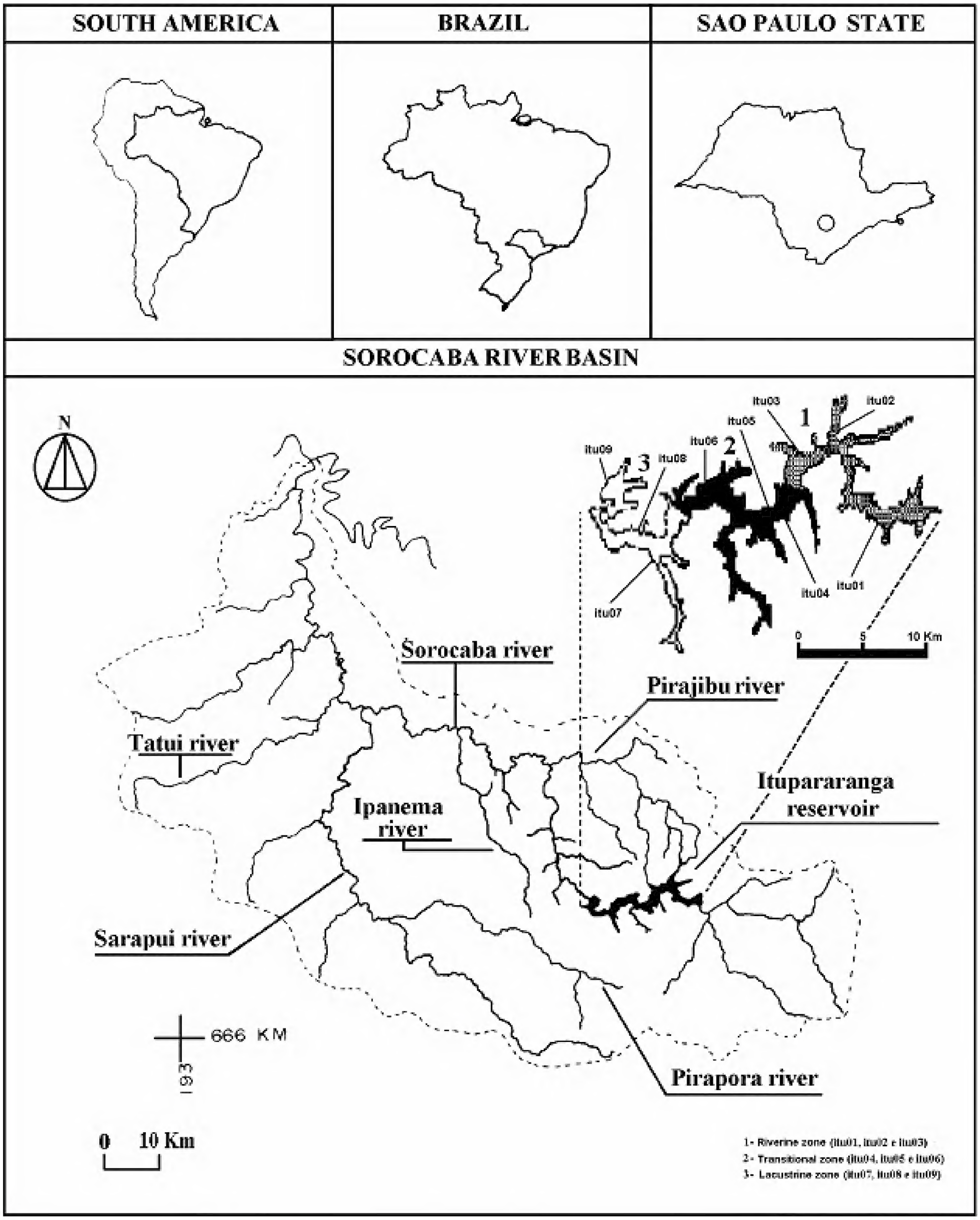

Figure 1. Sorocaba River basin, showing the location of the Itupararanga reservoir and the sampling stations.

Check List 2007: 3(2)
ISSN: 1809-127X

Materials and methods

Samplings were performed in nine sampling stations (Figure 1). Fishes were collected using eight pairs of monofilament gillnets of 10 m length each, with varied mesh sizes (30, 40, 50, 60, 70, 80, 100 and 120 mm mesh sizes between opposite knots). Samplings were carried out in the rainy (January, February, and March 1996) and dry (July and August 1996) seasons, which corresponded to our spatial scale of analysis. Gillnets were set overnight from 18:00 h to 06:00 h. The specimens were preserved in formalin (10 %). Identification was first performed using the identification keys of Britski (1972), Britski et al. (1984) and later confirmed by Dr. Heraldo Britski, (Museum of Zoology, University of São Paulo).

Results and discussion

In this work, 22 fish species were identified in the reservoir, distributed in 7 orders, 12 families and 20 genera. Characiformes was represented by 9 species followed by Siluriformes with 5 species, Perciformes and Gymnotiformes with 3 species, Cyprinodontiformes, Cipriniformes and Synbranchiformes with 1 species each. Among the families, Characidae and Pimelodidae are noticed, with 5 and 3 collected species, respectively. Of these species, 20 are natives, only 2 are exotic, such as the "tilapia" *Tilapia rendalli* and the "carp" *Cyprinus carpio*.

The low species richness found in the reservoir might be due to the fact that the area is close to the river head, thus presenting a lower richness and diversity than areas located below. Moreover, a decrease in species richness might have happened in the years following the damn constructions, due to a decrease in habitats suitable for reproduction and initial development of some species (Agostinho et al. 1997). These hypotheses however, are difficult to corroborate, as there is no study that attempted to follow species richness before and after the dam construction.

Petrere (1996) reported several effects of the damming upon the ichthyofauna, the most important ones being related to the isolation of populations and decrease in the number of migratory species. Damming can constitute, in several cases, an insurmountable barrier for any fish species, isolating sites and specific zones of the river where some species normally use for reproduction or as a feeding area (Beaumord 1991; Godoy 1995). This is verified in the Itupararanga reservoir where migratory fish species were rare. By the other hand there is a dominance of *Astyanax fasciatus* and *Cyphocharax modestus*, better adapted to lacustrine biotops. These two species are partial spawners, do not care for the eggs and larvae and present high fecundity (Barbieri and Barbieri 1988; Barbieri and Hartz 1995). They also utilize with efficiency the local resources in this lacustrine zone.

Castro and Arcifa (1987) reported that the most abundant and frequent species at several reservoirs in the São Paulo State were *Geophagus brasiliensis, Hoplias malabaricus*, *Astyanax bimaculatus*, *Astyanax fasciatus*, *Tilapia rendalli* and *Cyphocharax modestus*. This observation was confirmed at the Itupararanga reservoir, where *Astynax fasciatus* and *Cyphocharax modestus* were the most frequent species. More recent studies at the Barra Bonita (Castro 1994), Promissão (Amaral and Petrere 1994) and Americana (Romanini 1989) reservoirs also corroborate these results. This similarity was expected, as all these reservoirs are located at the same hydrographic basin. It is noteworthy that, as far as the reservoirs at the Tietê River basin are concerned, the species with the highest level of pre-adaptation to a lentic environment are: *Geophagus brasiliensis, Hoplias malabaricus*, *Astynax bimaculatus*, *Astynax fasciatus*, *Cyphocharax modestus*, *Iheringichthys labrosus* and *Oligossarcus paranensis*.

The remnant fish community in the reservoir is derived from the ichtyofauna that already existed in the dammed river (Fernando and Holcick 1991; Castro and Arcifa 1987; Agostinho et al. 1997). Colonization is performed mainly by species pre-adapted to the lacustrine conditions of the new environment. This was clear in the damming stations both at the Sorocaba River and at its affluent collected in the reservoir creeks basically the some species of the reservoir, as *Hoplias malabaricus*, *Steindachnerina insculpta*, *Rhamdia quelen*, *Iheringichthys labrosus* and *Oligossarcus paranensis*, which corroborates what was stated above.

LISTS OF SPECIES

Table 1. Fish species from the Itupararanga Reservoir.

	Species
CHARACIFORMES	
Characidae	
Tetragonopterinae	*Astyanax fasciatus* (Cuvier, 1819)
	Astyanax altiparanae Garutti & Britski, 2000
Characinae	*Galeocharax knerii* (Steindachner, 1870)
Acestrorhynchynae	*Acestrorhynchus lacustris* (Reinhardt, 1874)
	Oligosarcus paranensis (Meneses & Géry, 1983)
Erythrinidae	*Hoplias malabaricus* (Bloch, 1794)
Prochilodontidae	*Prochilodus lineatus* (Valenciennes, 1847)
Curimatidae	*Cyphocharax modestus* (Fernandez-Yepes, 1948)
	Cyphocharax nagelli (Steindachner, 1881)
CYPRINIFORMES	
Ciprinidae	*Cyprinus carpio* (Boulenger, 1897)
SILURIFORMES	
Callichthyidae	*Hoplosternum litoralle* (Hancock, 1828)
Pimelodidae	*Pimelodus maculatus* (Lacépède, 1803)
	Iheringichthys labrosus (Kröyer, 1855)
	Rhamdia quelen (Quoy & Gaimard, 1824)
Loricariidae	*Hypostomus ancistroides* (Ihering, 1911)
GYMNOTIFORMES	
Gymnotidae	*Gymnotus* cf. *carapo* (Linnaeus, 1758)
Sternopygidae	*Sternopygus macrurus* (Bloch & Schneider, 1801)
	Eigenmannia aff. *virescens* (Valenciennes, 1836)
PERCIFORMES	
Cichlidae	*Tilapia rendalli* (Boulenger, 1897)
	Geophagus brasiliensis (Quoy & Gaimard, 1824)
CYPRINODONTIFORMES	
Poecilidae	*Phaloceros caudimaculatus* (Hensel, 1868)
SYNBRANCHIFORMES	
Synbranchidae	*Synbranchus marmoratus* (Bloch, 1795)

Acknowledgements
We acknowledge FAPESP (95/1311-0), FNMA/ FUNDUNESP (046/95), and CNPQ for financial support; also Walter Barrella for comments, Luciano Bonatti Regalado, PUC-SP, and CRHEA - USP São Carlos, for logistic support.

LISTS OF SPECIES

Literature cited

Agostinho A. A., H. F. Júlio Jr., and J. R. Borghetti. 1992. Considerações sobre os impactos dos represamentos na ictiofauna e medidas para sua atenuação. Um estudo de caso: Reservatório de Itaipu. Revista Unimar 14: 89-107.

Agostinho A. A. and M. Zalewski. 1996. A planície alagável do alto rio Paraná: importância e preservação. Maringá: EDUEM, 100 p.

Agostinho A. A., Julio Jr. H. F., and M. Petrere Jr. 1994. Itaipu reservoir (Brazil): impacts of the impoundment on the fish fauna and fisheries. Pp. 161-184. In. I.G. Cowx (ed.), Rehabilitation of Freshwaters Fisheries, Oxford Fishing News Books.

Agostinho A. A., L. M. Bini, and L. C. Gomes. 1997. Ecologia de comunidades de peixes da área de influência do reservatório de Segredo. pp. 97-111. In: A.A. Agostinho & L.C. Gomes (ed.), Reservatório de Segredo: bases ecológicas para o manejo. Maringá: EDUEM.

Amaral B. D. and M. Petrere Jr. 1994. Habitat fatores físico-químicos relacionados às comunidades de peixes do reservatório da UHE "Mário Lopes Leão-Promissão (SP). Pp. 277-293. In I Encontro Brasileiro de Ciências Ambientais, Rio de Janeiro.

Barrella, W. 1998. Alterações das comunidades de peixes nas bacias dos rios Tietê e Paranapanema (SP), devido a poluição e ao represamento. Ph. D. Thesis, Rio Claro, UNESP, 115 p.

Barbieri G. and M. C. Barbieri. 1988. Curva de maturação, tamanho de primeira maturação gonadal e fecundidade de *Astyanax bimaculatus* e *Astyanax fasciatus* da represa do Lobo, Estado de São Paulo (Osteichthyes, Characidae). Ceres 35(197): 64-77.

Barbieri G. and S. M. Hart. 1995. Estudo da fecundidade e tamanho de primeira maturação gonadal de Cyphocharax modestus (Hensel, 1869) da represa do Lobo, Estado de São Paulo (Osteichthyes, Curimatidae). Comunicações em Ciência e Tecnologia 8: 27-35.

Beaumord A. C. 1991. As Comunidades de Peixes do Rio Manso, Chapada dos Guimarães, MT: Uma abordagem Ecológica Numérica. Master Dissertation, Rio de Janeiro, UFRJ. 107 p.

Beaumord, A. C. and M. Petrere 1994. Comunidades de Peces Del Rio Manso, Chapada Dos Guimaraes, MT, Brasil. Acta Biologica Venezuelica 5(2): 21-35.

Britski H. A. 1972. Peixes de água doce de Estado de São Paulo: Sistemática. Pp.83-108. In Comissão Interestadual da Bacia Paraná-Uruguai. Poluição e Piscicultura, São Paulo.

Britski H. A., Y. Sato, and A. B. S. Rosa. 1984. Manual de identificação de peixes da Bacia do São Francisco - Brasília. Brasília: Câmara dos Deputados, Coordenação de Publicações - CODEVASF, Divisão de Piscicultura e Pesca, 143 p.

Castro A. C. L. 1994. Ictiofauna do Reservatório de Barra Bonita-SP: Aspectos ecológicos da Comunidade e Dinâmica populacional da corvina, *Plagioscion squamosissimis* (Heckel, 1840) (Acanthopterigii, Scianidae). Ph. D. Thesis, São Carlos, Escola de Engenharia de São Carlos, Universidade de São Paulo.

Castro R. M. C. and M. F. Arcifa. 1987. Comunidades de peixes de reservatórios do sul do Brasil. Revista Brasileira de Biologia 47(4): 493-500.

Duncan A. and J. Kubecka 1995. Land/water ecotone effects in reservoirs on the fish fauna. The importance of aquatic-terrestrial ecotones for freshwater fish. F. Schiemer, M. Zalewski, and J. E. Thorpe (ed.). Hidrobiologia 303: 11-30

Fernando C. H. and Holcick J. 1991. Fish in reservoirs. Int. Revue Ges. Hydrobiol. 76(2), 149-167.

Godoy M. P. 1995. Piracema: peixes brasileiros também tem história. Pirassununga-SP, Brasil. Anais de Etologia 13: 3-19.

Petrere M. 1996. Fisheries in large tropical reservoirs in South America. Lakes & Reservoirs: Research and Management 2: 111-133.

LISTS OF SPECIES

Romanini P. U. 1989. Distribuição e Ecologia Alimentar de peixes no reservatório de Americana, São Paulo. Master Dissertation, São Paulo, Universidade de São Paulo.

Smith W. S. 1999. A estrutura da comunidade de peixes da bacia do rio Sorocaba em diferentes situações ambientais. Master Dissertation, São Carlos, Universidade de São Paulo, 121 p.

Smtih W. S. and M. Petrere 2001. Peixes em represas: o caso de Itupararanga. Ciência Hoje 29(170): 74-78.

Smith, W. S., E. L. G., Espíndola, C. C. G. F. Pereira, and O. Rocha. 2002. Impactos dos reservatórios do médio e baixo Tietê (SP) na composição das espécies de peixes e na atividade de pesca. Pp. 57-72. In: Recursos hidroenergéticos: usos, impactos e planejamento integrado, São Carlos.

Received March 2007
Accepted April 2007
Published online Mayl 2007